Effects of sex and breeding status on habitat selection by feral House mice (*Mus musculus*) on a small Mediterranean island

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Abstract

Patterns of habitat use of the house mouse (*Mus musculus*) in relation to sex and breeding status were studied in April and May (the early breeding season) in two structurally different habitats on a small Mediterranean island in NE Spain. Overall mice abundance increased from bare and rocky areas to areas with a dense cover of shrubs and herbaceous plants. Females were associated to shrub areas in April, shifting towards more herbaceous areas in May. Males were less selective, being only slightly related to shrub height in April, and they were not associated with structural habitat features in May. Overlap in habitat use by sexes existed in both months, being more reduced in April than in May.

Female densities were significantly higher in the habitat with dense vegetation cover (suitable habitat) than in the habitat with scarce vegetation in both months, while densities of males were not. Male density decreased from April to May in the suitable habitat, and intersexual competition was exclusively detected in the period of higher male density. In this habitat, intraspecific competition explained the spatial distribution of sexes regardless of habitat structure characteristics. In absence of competition the spatial distribution of sexes was mainly related to habitat structure.

Females and males started sexual activity early in the season in the suitable habitat. Weight of females was higher in suitable habitat in both months, also showing a positive association with the herbaceous cover, and the average weights of males and females at trapping stations were positively associated.

Our results are finally discussed in relation to the social organisation models proposed for house mouse populations.

Key words: *Mus musculus*, island, habitat selection, sex, breeding status

Introduction

The house mouse is a widespread species, living in mainland Europe as well as on Mediterranean islands (Orsini et al. 1983; Amori et al. 1984). Northern populations are mainly comensal to human settlements but live outdoors for a great part of the year (Carlsen 1993). In Southern Europe, however, feral populations are found throughout the year, e. g. in Mediterranean habitats (Cassaing and Croset 1985; Cagnin et al. 1996). Also Iberian populations are mainly linked to human dwellings (Sans-Coma et al. 1987; Gosàlbez 1987) but some local and well-established feral populations are present in moist habitats (Gosàlbez 1987). Some differences in habitat selection are related to interspecific competition, of which this species seems especially sensitive (Boitani et al.

1985; FAIRLEY and SMAL 1987). Additionally, its distribution is conditioned in insular habitats by competition with other rodent species rather than by habitat structure (DUESER and PORTER 1986).

Mammal communities on islands differ in some ecological aspects from those on the mainland (BLONDEL 1986). These differences are mainly related to the degree of isolation, which is a problem to the colonisation of non-volant mammals from the mainland. They are also related to the surface and the size of the island, where small areas are not to be colonized by medium- or large-sized mammals, i.e., carnivores (BLONDEL 1986). As a consequence, smaller islands normally are poor in species, and small mammal communities living on islands have special features of habitat use because of reduced predation pressure and interspecific competition (CROWELL 1983).

In this study we investigated the physical cues that may influence habitat use of a feral house mouse population on a small archipelago uninhabited both by humans and also by other rodents. Our objectives are to analyse spatial distribution of the species at a certain time in relation to habitat structure, sex, and breeding status, and to provide some information on the social organisation of house mice in insular habitats.

Material and methods

The study was performed on the Medes Islands (42°0′N, 3°13′E, NE Spain) during spring 1996. These islands are a small calcareous archipelago only 0.9 km off the coast. The vegetation of the archipelago is dominated by nitrophylous communities linked to the presence of one of the largest breeding colonies of yellow-legged gulls (*Larus cachinnans*) in the Mediterranean (BOSCH et al. 1994). Three main habitats differing in vegetation features are distinguished within the islands: (1) shrubby habitat, dominated by *Atriplex halimus*, a dense shrub which reaches 70–100 cm height; (2) grassy habitat, dominated by grassy, ruderal plants, such as *Hordeum murinum*; and (3) bare habitat, with very scarce vegetation, bare ground and dispersed rocks (see BOSCH and SOL 1998). The archipelago was transitorily occupied by humans until 1923, being deserted for the last 70 years. The small mammal community of these islands is composed of house mice (*Mus musculus*) and white-toothed shrews (*Crocidura russula*) (GOSÀLBEZ et al. 1984).

Two plots of 49 and 25 Sherman live traps (i.e. 7 rows×7 columns of traps, and 5 rows×5 columns of traps, respectively, equidistance between traps 16.6 m) were set during three consecutive days from 31 March to 2 April (first session), and from 26 to 28 May (second session) on the largest island of the archipelago (Meda Gran, 18.2 ha). The study was conducted during the early breeding season of the house mouse which is described to last from spring to late summer on the Medes islands (GOSÀLBEZ et al. 1984). Traps were baited with a mixture of tuna fish in olive oil and flour to allow increasing trappability, since low trappability might explain low recapture rates (KREBS et al. 1994). Trapping effort for each trapping session was 222 trapnights/session. The large plot was 1 ha in area and included the shrubby and grassy habitats, while the small one was 0.5 ha and only included the bare habitat.

The trapping plots were examined early in the morning and the animals found were identified, weighed, sexed, examined for reproductive condition and marked by toe-clipping (GURNELL and FLOWERDEW 1990), and released at the trap station. To allow comparisons between plots and months, population densities were estimated as the average number of individuals caught per trapping station during the three consecutive days.

The habitat structure was characterized at each trap station at the same time when trapping was conducted, by means of estimating values of height and cover on a 5 m radius circular plot centred around the Sherman trap (ALCÁNTARA and TELLERÍA 1991).

Two factorial analyses (BHATTACHARYYA 1981) were performed (one per month) with the habitat structure variables of all traps to obtain independent multivariate factors considered as gradients to which the frequencies of occurrence of the small mammals refer.

To ascertain preferences of the house mouse spatial distribution, the frequency of captures at each trap station was considered as a relative measure of density in the surrounding habitat (DUESER and HALLETT 1980), and then was related to the habitat structure variables by means of non-para-

metric Spearman correlation analysis. To test for intersexual competition and its influence on habitat use, we used the method described by HALLETT and PIMM (1979). The unweighed average situations of the sexes on the factorial space were obtained by averaging the values of the factor scores of the trapping stations with captures on the factors extracted. To ascertain the habitat variables that best explained the abundance of the house mice, stepwise multiple regression analysis was performed, with the frequencies of occurrence as dependent variables and the habitat variables as the independent ones (YAHNER 1982). To avoid autocorrelation in habitat variables, multiple regression analyses were also performed with factors as the independent variables, and the Bonferroni correction was applied when necessary to maintain $\alpha < 0.05$ (RICE 1989).

Microhabitat characterization of the house mouse feral population was estimated as the average values of the habitat variables at the trap stations where the species or sexes were trapped (selected areas). These values were compared with the average values of the habitat variables at the trap stations where the species or sexes were not trapped (non selected areas), using the Kruskal-Wallis ANOVA. When possible, these tests were also used to verify sexual and temporal habitat preferences. Mann-Whitney U-tests were performed to ascertain differences in habitat preferences between sexes, and for the same sex between different trapping sessions. To simplify the statistical analysis, overlap in habitat use by sexes was estimated as the z-value obtained when testing for differences between average values of both sexes on each of the multivariate factors extracted (using Mann Whitney U-test). The greater the z-value the smaller is the overlap.

Possible differences in the relative abundances of house mice between plots, months or sexes were tested by Chi-square analysis (with the Yates' correction for continuity) on standardized trapping areas.

The differences between the two sampling periods in habitat structure as well as in house mouse variables at the same trapping stations were tested with the Wilcoxon signed-rank test for matched pairs. Before parametric statistical treatment, variables were log (x + 1) and arcsine transformed (ZAR 1996).

Results

Habitat structure

The two habitats sampled were structurally different in both periods (Tab. 1). Plot 1 was characterized by higher values of vegetation cover, and plot 2 by higher values for the slope and rock cover. Monthly variation of habitat structure was only observed in the herbaceous cover and height.

The factorial analysis performed with the structural variables yielded similar results in both periods. In April, two eigenvectors were extracted, explaining altogether 75.5% of the structural habitat variance (Tab. 2). The first factor was positively correlated to the rock and dead vegetation cover and to the slope. It was negatively related to shrub and herbaceous cover, and height of shrubs and herbaceous plants. This factor was interpreted as the negative effects of the increasing slope on the establishment of vegetation strata. The second factor was positively related to shrub cover, shrub height, and slope, but negatively related to herbaceous height. Since shrub cover and height had positive loadings, and herbaceous cover had a negative loading, this factor was interpreted as a negative effect of the shrub plants on the development of the herbaceous plants. The factorial analysis conducted in May yielded similar results (Tab. 2).

House mouse abundance in relation to sex and breeding status

61 individuals of *Mus musculus* (37 males, 24 females) were trapped in April, and 46 individuals (22 males, 24 females) were trapped in May (Tab. 3).

The relative abundance of *M. musculus* was greater in plot 1 than in plot 2 for both periods (April: $\chi^2 = 7.88$, p < 0.01, d. f. = 1; May: $\chi^2 = 7.54$, p < 0.01, d. f. = 1). Male density decreased from April to May ($\chi^2 = 3.90$, p < 0.05, d. f. = 1), while female density remained

Table 1. Structural variables (mean ± standard error) measured at trapping stations in plots one and two in both periods (April and May), and average and s.e. values for the house mouse densities and weights. Differences between plots tested with Mann Whitney U-tests, and differences between sampling periods with Wilcoxon tests (level of significance: * (p < 0.05), ** (p < 0.01), *** (p < 0.001), **** (p < 0.0001)).

Variable	April			May			Differences April–May	
	Plot 1 (n = 49)	Plot 2 (n = 25)	U-test z and p	Plot 1 (n = 49)	Plot 2 (n = 25)	U-test z and p	Plot 1 z and p	Plot 2 z and p
Slope (%)	4.28 ± 0.96	15.2 ± 1.96	4.94****	4.28 ± 0.96	15.2 ± 1.96	5.41****	0	0
Rock cover (%)	7.95 ± 1.36	42.08 ± 4.46	5.84****	7.95 ± 1.36	42.0 ± 3.82	6.34****	0	0.92
Shrub cover (%)	25.2 ± 3.9	0.41 ± 0.28	4.78****	26.02 ± 3.74	0.16 ± 0.11	4.90****	0.89	1.78
Height of shrubs (cm)	77.58 ± 8.35	5.35 ± 4.28	4.71****	77.60 ± 7.93	5.60 ± 3.91	4.90****	0.25	1.78
Herbaceous cover (%)	66.92 ± 3.22	4.0 ± 1.62	6.82****	59.59 ± 2.50	37.60 ± 3.61	4.23****	3.40***	4.30****
Herbaceous height (cm)	37.48 ± 1.99	3.90 ± 1.81	6.50****	82.32 ± 2.99	24.59 ± 3.54	6.88****	6.09****	3.95***
Dead vegetation (%)	9.92 ± 1.12	32.08 ± 3.37	5.52****	21.74 ± 1.44	14.20 ± 2.57	3.12**	4.48****	3.53***
Density								
females	0.42 ± 0.10	0.12 ± 0.06	1.74	0.53 ± 0.10	0.16 ± 0.09	2.34**	0.80	0.13
males	0.67 ± 0.12	0.40 ± 0.11	0.97	0.32 ± 0.07	0.40 ± 0.14	0.03	2.30*	0.08
total	1.14 ± 0.16	0.52 ± 0.14	2.19*	0.85 ± 0.14	0.56 ± 0.19	1.33	1.47	0.40
Body weight (g)								
females	17.60 ± 0.57	12.0 ± 1.0	2.51**	20.05 ± 1.15	13.5 ± 1.32	1.90*	2.31*	1.61
males	15.78 ± 0.42	15.33 ± 0.95	0.13	17.0 ± 0.84	16.89 ± 0.74	0.10	0.81	0.70
total	16.35 ± 0.35	15.00 ± 0.81	1.40	18.89 ± 0.69	16.00 ± 1.09	1.97*	3.23**	0.62

Table 2. Factorial analysis performed with the habitat structure variables in both months, and level of significance of the correlations between variables and factors (see Tab. 1).

Variable	April		May	
	Factor 1	Factor 2	Factor 1	Factor 2
Slope	0.68****	0.45****	0.69****	0.30**
Rock cover	0.78****	0.14	0.85****	0.07
Shrub cover	–0.63****	0.71****	–0.62****	0.75****
Shrub height	–0.73****	0.58****	–0.68****	0.63****
Herbaceous cover	–0.83****	–0.43***	–0.56****	–0.70****
Herbaceous height	–0.88****	–0.09	–0.88****	–0.14
Dead vegetation cover	0.70****	0.09	–0.49****	–0.19
Eigenvalue	4.00	1.28	3.42	1.62
% Variance	57.2	18.3	48.9	23.1
Ac. % Variance	57.2	75.5	48.9	72.1

Table 3. Number of house mouse individuals trapped in relation to sex (n), frequency of recapture (FR) within the same sampling period and breeding status (BS: frequencies of active males with scrotal testes and pregnant females) in the two plots (P1 and P2) and sampling periods (April and May).

	April						May					
	P1			P2			P1			P2		
	n	FR	BS	n	FR	BS	n	FR	BS	n	FR	BS
males	28	17.8	65.3	9	11.1	33.3	16	6.2	47.6	6	66.6	83.3
females	20	14.2	28.5	4	0	0	20	30	80.9	4	0	25

Table 4. Spearman non-parametric correlation matrix between house mouse relative abundances and habitat structural variables in both months (significance levels as in Tab. 1). F1 = Factor 1; F2 = Factor 2; Rc = Rock cover; Sc = Shrub cover; Sh = Shrub height; Hh = Herbaceous height; only significant correlations (p < 0.007, Bonferroni correction) are shown. Slope, dead vegetation, and herbaceous cover with no significant correlations. Levels of significance as in Tab. 1.

Group	Month	F1	F2	Rc	Sc	Sh	Hh
females	April	–0.30**	0.36***	–0.31**	0.44***	0.32**	
	May	–0.29**					0.35**
males	April					0.05*	
	May						
total	April	–0.37***	0.45****		0.46****	0.41***	0.36**
	May						
total	April + May	–0.35**	0.39***		0.48****	0.37***	0.36**

the same ($\xi^2 = 0.01$, p > 0.05, d. f. = 1). Considering the captures on both plots, the sex-ratio was biased towards males in April (males:females, 1.7:1; $\xi^2 = 4.42$, p < 0.05, d. f. = 1), but not in May (males:females 1.1:1; $\xi^2 = 2.7$, p > 0.05, d. f. = 1).

Both males and females attained sexual activity earlier in plot 1 (Tab. 3). Later the number of active males decreased at the same time when females become pregnant. In plot 2, females could be considered transient since no recaptures were obtained. Sexually active males increased later in plot 2, and the high recapture rate obtained might be considered as a degree of site-attachment.

General patterns of abundance in relation to habitat structure

M. musculus showed clear patterns of relative abundance in relation to habitat structure in April, but a more vague pattern in May (Tabs. 4 and 5). The habitat structure variables that explained most of the presence of the species were the height of shrubs in April and the herbaceous height in May. Pooling capture data from both months, *M. musculus* showed significant preferences for traps with higher values for height and cover of shrubs ($r_s = 0.90$ and $r_s = 0.88$, respectively, n = 7, p < 0.05; Fig. 1).

Table 5. Results of the stepwise multiple regression analysis performed with the habitat structure variables or factors as independent variables, and house mouse relative abundance as dependent variables, showing the first variables selected and the percentage of variance explained by the models. Levels of significance as in Tab. 1.

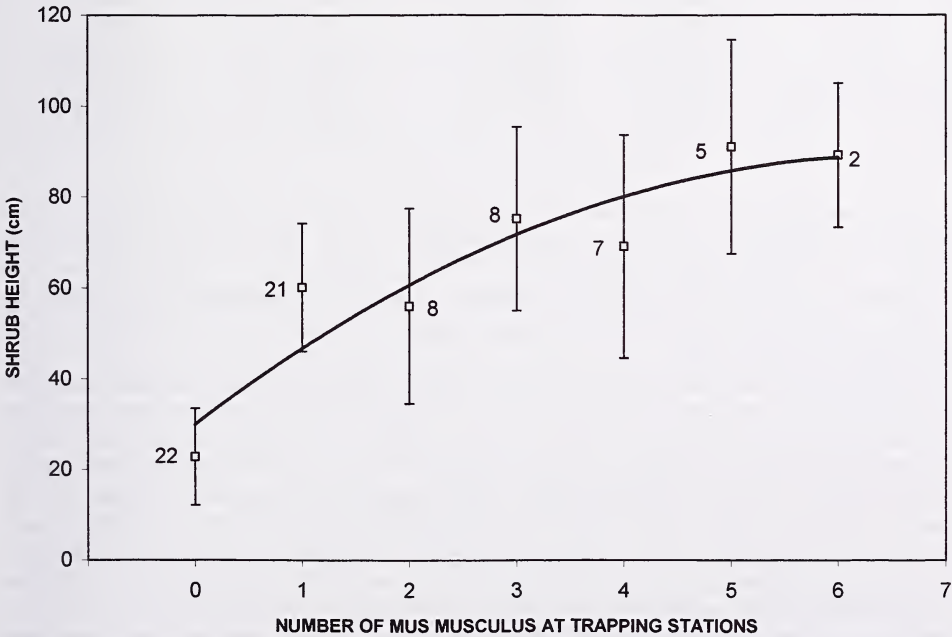| Dependent variable	April Variable selected	R^2 and p	May Variable selected	R2 and p	April + May Variable selected	R^2 and p
males	–	0	–	0	Factor 2	0.06**
	Shrub height	0.05*	–	0	Shrub cover	0.05*
females	Factor 1	0.17****	Factor 1	0.06**	Factor 1	0.22****
	Shrub cover	0.18****	Herbaceous height	0.07**	Shrub cover	0.23****
total	Factor 2	0.23****	–	0	Factor 1	0.21****
	Shrub height	0.22****	Herbaceous height	0.06**	Shrub height	0.23****

Fig. 1. Frequencies of capture of *Mus musculus* at trapping stations in relation to average (± standard error) of shrub height. Numbers are sample sizes for each category.

Microhabitat preferences in relation to sex and month

A) April: Females showed marked microhabitat preferences, while males did not. Females showed significant correlations with both factors; their abundance increased along factor 2 and decreased along factor 1 (Tab. 4), meaning that areas with higher vegetation cover and height were selected and rock covered areas were avoided. The shrub cover explained the greater amount of variance (19%) in female correlations with the structural variables, followed by height of shrubs (10%), rock cover (9%) and herbaceous height (8%). Males did not show any correlation with both factors and only one correlation with the structural variables (Tabs. 4 and 5). Habitat used by both sexes overlapped in both factors (values for overlap on F1 and F2 were 0.91 and 1.18, respectively), but females were more selective. Furthermore, the centroids of males and females on both factors differed significantly from the centroids of the non-capture sites (Tab. 6), suggesting the avoidance of a part of the habitat available. The distance of the factorial space defined by factors 1 and 2 from male to female centroids was 0.46.

Table 6. Situation (average ± standard error) of *Mus musculus* (males, females and both sexes pooled) on the structural factors extracted by the factorial analyses performed in both months, and average situation of non-capture sites. Asteriscs show significant differences between mean values of the species or sexes and the non-capture values on both factors (differences tested with U-Mann-Whitney tests, and level of significance as in Tab. 1).

Variables	April		May	
	Factor 1	Factor 2	Factor 1	Factor 2
males	-0.16 ± 0.18*	0.22 ± 0.18***	-0.10 ± 0.20	0.34 ± 0.18
	(n = 31)	(n = 31)	(n = 22)	(n = 22)
females	-0.49 ± 0.17**	0.56 ± 0.21****	-0.42 ± 0.16**	0.12 ± 0.24
	(n = 18)	(n = 18)	(n = 22)	(n = 22)
total	-0.25 ± 0.15**	0.29 ± 0.15****	-0.21 ± 0.14*	0.06 ± 0.17
	(n = 40)	(n = 40)	(n = 32)	(n = 32)
Non-capture sites	0.34 ± 0.16	-0.41 ± 0.15	0.25 ± 0.17	-0.19 ± 0.15
	(n = 32)	(n = 32)	(n = 38)	(n = 38)

The average weight of females was higher in plot 1 (Tab. 1), and was positively correlated to the herbaceous cover ($r_s = 0.52$, n = 18, p < 0.05). Thus, heavier females were found on areas with higher herbaceous cover. The average weight of males did not show any relation with the habitat structure variables. Otherwise, a significant and positive correlation was found between the average weight of both sexes at trapping stations ($r_s = 0.69$, n = 10, p < 0.05).

B) May: The variance explained by the stepwise regression models performed in May with the house mouse relative abundances and the habitat structure variables or factors was derived from the presence of females alone (Tab. 5). On the other hand, the number and significance of correlations between relative abundance and structural variables decreased (Tab. 4). The herbaceous height explained the greater amount of variance in female abundance (12%), followed by rock (7%) and shrub cover (6%). Females correlated negatively with factor 1, but no significant correlation was found with factor 2. Males did not show any correlation with factors or structural variables (Tab. 4). Habitat used by both sexes overlapped in both factors (1.13 on F1 and 0.10 on F2), but the distance on the factorial space defined by factors 1 and 2 from male to female centroids (0.37) was nearly the same as the distance observed in April (0.46). From April to May, habitat used by females shifted along factor two (0.44 units), and slightly along factor 1

(0.07 units). Since factor two is negatively correlated to the herbaceous cover, the increase in female's mean values for this factor can be interpreted as a displacement towards more herbaceous areas. The shift of males was moderate (only 0.13 units for the factorial space).

The average weight of both sexes did not show any relation with the habitat structure variables, but the average weight of females in plot 1 was higher than in plot 2, as occurred in April.

Intersexual competition and habitat use

Negative male-female interactions were detected in April on plot 1, and symmetrical intersexual competition explained the spatial distribution of sexes regardless of habitat structure. In April on plot 2 no male-female interactions were detected, and the spatial distribution of sexes was related mainly to habitat structure characteristics (Tab. 7). The same occurred in May on plot 1, and on plot 2: neither intersexual competition nor habitat structure influenced the spatial distribution of sexes.

Table 7. Multiple regression analysis performed in April and May with the frequencies of occurence of one sex as the dependent variable and both factors extracted and the frequencies of occurence of the other sex as independent variables. The partial regression coefficients, t-values and levels of significance are shown (see Tab. 1).

Month	Plot	Dependent variable	Variables selected	Coefficient	t and p
April	1	Female	Male	–0.48	2.72**
		Male	Female	–0.45	2.72**
April	2	Female	factor 1	–0.60	2.04
		Male	factor 1	0.67	3.74**
			factor 2	0.35	2.69*
May	1	Female	factor 2	0.27	2.19*
		Male	factor 1	0.25	2.30*
May	2	Female	–	–	–
		Male	–	–	–

Discussion

On the Medes Islands the house mouse showed an increasing pattern of its relative abundance from bare and rocky areas to areas covered by shrubby and grassy vegetation. These results are in agreement with the pattern observed in another insular population of *Mus musculus* (DUESER and PORTER 1986). *M. musculus* is sensitive to interspecific competition (FAIRLEY and SMAL 1987), since its mainland distribution seems to be restricted by the presence of some rodent species which in sympatry exclude *M. musculus* from natural environments (BOITANI et al. 1985; AUFFRAY et al. 1990). Insular populations of *M. musculus* are also sensitive to interspecific competition (DUESER and PORTER 1986), and the absence of competitors from the Medes Islands could allow *M. musculus* to inhabit natural xeric environments, as reported for feral mainland populations in absence of *M. spretus* (ORSINI et al. 1982; AUFFRAY et al. 1990; CAGNIN et al. 1996).

The pattern of house mice abundance varied when considering the sampling month, the habitat sampled, and the sex of the individuals trapped. Females density was higher in the plot with higher vegetation cover (suitable habitat). Since females start sexual activity in early spring (GOSÀLBEZ et al. 1984), the higher male density in April might be a

consequence of competition for mating with sexually active females, and the lower density in May as a result of the decreasing number of potential mating partners, with most of the females being pregnant or lactating. Female recapture rates increased as the breeding season progressed on a suitable plot (suggesting a degree of female site-attachment inherent to pregnancy or lactation, Krebs et al. 1994), while male recapture rates decreased at the same time, suggesting a contrary pattern with a greater mobility. The increasing number of active males on the non-suitable plot late in the season could be interpreted as the displacement of active males from suitable to non-suitable habitats in search of sexually active females.

Our results agree with the general pattern of habitat use found in other small mammals, with females selecting microhabitats that provide greater protective cover (Seagle 1985). They tend to shift towards more herbaceous-covered areas as the season progresses (Belk et al. 1988). Males were competing for breeding females (Krebs et al. 1995), and they showed a more reduced habitat selectivity (Belk et al. 1988). This may result from a direct consequence of their greater mobility or from an indirect consequence of their association with females. Different habitat utilisation by sexes seems likely to exist with the consequence to decrease intraspecific competitive pressure on reproductive females (Seagle 1985). Bowers and Smith (1979) documented a case for *Peromyscus maniculatus* in which such a segregation was a result of female dominance over males due to larger body size being a way to maximize reproductive effort. In spite of a general absence of sexual dimorphism concerning body size (Gosàlbez et al. 1984), female house mice were heavier (probably caused by pregnancy) than males throughout the study period on the more suitable plot, and females trapped on this plot were heavier than females trapped on the other plot, regardless time of sampling. The positive relationship between average weight of males and females at trapping stations suggested a hierarchical displacement of subordinates to unfavourable microhabitats by dominant individuals, as has also been reported in laboratory studies (Reimer and Petras 1967).

Finally, the characteristics of the house mouse population studied seems to be in agreement with the social organisation model proposed by Newsome (1969) and supported by Krebs et al. (1995), with feral house mouse populations not being territorial but showing social dominance through body size. Dominant females may aggregate in high resource quality areas, as has been reported for wood mice (Montgomery et al. 1991), and energetic advantages for these females could arise as a result of habitat selection, reducing predation risk (Price and Brown 1983), increasing foraging efficiency (Thompson 1982), or may be living under more favourable microclimatic conditions (Walsberg 1985).

Acknowledgements

Zusammenfassung

Auswirkungen von Geschlecht und Fortpflanzungsstatus auf Habitatwahl bei freilebenden Hausmäusen (Mus musculus) auf einer kleinen Mittelmeerinsel

Das Muster der Lebensraumnutzung von freilebenden Hausmäusen (*Mus musculus*) in bezug auf Geschlecht und Fortpflanzungsstatus wurde während des Frühjahrs (April und Mai, d. h. zu Beginn

der Fortpflanzungsperiode) in zwei strukturell verschiedenen Lebensräumen auf einer kleinen Mittelmeerinsel im NE Spaniens untersucht. Im Allgemeinen zeigte die Zunahme in der Abundanz der
Hausmaus von felsigen und pflanzenlosen Gebieten zu Bereichen mit einer dichten Deckung durch
Sträucher und krautige Pflanzen eine deutliche Bevorzugung bestimmter Habitatstrukturen. Betrachtet man die Geschlechter getrennt, so ergab sich während beider Untersuchungsperioden, daß die
Weibchen deutlich wählerischer waren. Eine schrittweise multiple Regressionsanalyse zeigte, daß die
Weibchen im April buschartige Gebiete bevorzugten und im Mai zu krautigen Gebieten wechselten.
Die Verbreitung der Männchen zeigte im April eine schwache Beziehung zur Höhe der Pflanzen, im
Mai war das Vorkommen dagegen weitgehend unabhängig von den Eigenschaften des Lebensraumes.
Während beider Monate war in beiden Geschlechtern eine Überlappung in bezug auf den Lebensraum zu beobachten, die im April geringer ausgeprägt war als im Mai.

In beiden Monaten war die Dichte der Weibchen in pflanzenreichen Gebieten deutlich höher als
in Gebieten mit spärlichem Pflanzenwuchs. Die Siedlungsdichte der Männchen war dagegen in beiden
Gebieten gleich, und ihre Dichte nahm von April bis Mai ab. Konkurrenz innerhalb der Art (Männchen–Weibchen-Wechselwirkung) wurde auschließlich in dem Monat mit höherer männlicher Dichte
beobachtet. In diesem Lebensraum war die Konkurrenz durch die räumliche Verteilung der Geschlechter bestimmt und weitgehend unabhängig von den strukturellen Eigenschaften der Gebiete.
Ohne diese Konkurrenz war die räumliche Verteilung der Geschlechter hauptsächlich auf die Lebensraumstruktur bezogen.

Im günstigen Lebensraum begannen Weibchen und Männchen ihre sexuelle Aktivität zu Anfang
der Fortpflanzungsperiode. Während beider Monate lag das Gewicht der Weibchen in den günstigen
Lebensräumen höher als in den ungünstigen und zeigte darüber hinaus einen positiven Zusammenhang mit der pflanzlichen Bedeckung des Gebietes. An den Fangstellen war das durchschnittliche Gewicht der Männchen positiv mit dem der Weibchen korreliert.

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